



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 5  
77 WEST JACKSON BOULEVARD  
CHICAGO, IL 60604-3590

Page 1 of 13

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
UNDERGROUND INJECTION CONTROL  
CLASS III AREA PERMIT

Permit Number: MI-163-3A-0001

Facility Name: Buckeye Woodhaven Terminal

Pursuant to the provisions of the Safe Drinking Water Act, as amended (42 U.S.C. 300f et seq., commonly known as the SDWA) and implementing regulations promulgated by the United States Environmental Protection Agency (EPA) at Parts 124, 144, 146 and 147 of Title 40 of the Code of Federal Regulations (40 C.F.R.),

**Buckeye Terminals, LLC of Houston, Texas**

is authorized to construct and operate four injection wells located in a permit area limited to that described in Part III(D) of this permit, upon the express condition that the permittee meet the restrictions set forth herein. Injection shall be limited to the Salina B Salt between 1070 and 1150 feet. Injection shall not commence until the operator has received authorization in accordance with Part I(E)(10) of this permit.

The injection shall be limited to solution mining.

All references to Title 40 of the Code of Federal Regulations (40 C.F.R.) are to all regulations that are in effect on the date that this permit is effective. All terms used in this permit shall have the meaning set forth in the SDWA and 40 C.F.R.

This permit shall become effective on NOV 11 2019 and shall remain in full force and effect during the operating life of the wells, unless this permit is otherwise modified, revoked and reissued or terminated pursuant to 40 C.F.R. §144.39, 144.40 and 144.41. The permit will expire in one year if the permittee fails to commence construction, unless a written request for an extension of this one-year period has been approved by the Director. This permit shall also remain in effect upon delegation of primary enforcement responsibility to the State of Michigan unless that State chooses to adopt this permit as a State permit. This permit will be reviewed at least every five years from the effective date specified above.

Signed and dated: 09/27/19

Linda Holst  
Joan M. Tanaka  
Acting Director, Water Division

*for*



## **PART I GENERAL PERMIT COMPLIANCE**

### **A. EFFECT OF PERMIT**

The permittee is allowed to engage in underground injection in accordance with the conditions of this permit. Notwithstanding any other provisions of this permit, the permittee authorized by this permit shall not construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of injection, annulus or formation fluids into underground sources of drinking water (USDWs). The objective of this permit is to prevent the introduction of contaminants into USDWs if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 C.F.R. Part 141 or may otherwise adversely affect the health of persons. Any underground injection activity not specifically authorized in this permit is prohibited. For purposes of enforcement, compliance with this permit during its term constitutes compliance with Part C of the Safe Drinking Water Act (SDWA). Such compliance does not constitute a defense to any action brought under Section 1431 of the SDWA, or any other common or statutory law other than Part C of the SDWA. Issuance of this permit does not convey property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of State or local law or regulations. Nothing in this permit shall be construed to relieve the permittee of any duties under applicable regulations.

### **B. PERMIT ACTIONS**

This permit may be modified, revoked and reissued, or terminated for cause as specified in 40 C.F.R. §§144.39, 144.40, and 144.41. The filing of a request for a permit modification, revocation and reissuance, termination, or the notification of planned changes or anticipated noncompliance on the part of the permittee does not stay the applicability or enforceability of any permit condition.

### **C. SEVERABILITY**

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

### **D. CONFIDENTIALITY**

In accordance with 40 C.F.R. Part 2 and Section 144.5, any information submitted to the EPA pursuant to this permit may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, EPA may make the information available to the public without further notice. If a claim is asserted, the validity of the claim will be assessed in accordance with the procedures in 40 C.F.R. Part 2 (Public Information). Claims of confidentiality for the following information will be denied:

- (1) The name and address of the permittee; and

(2) Information that deals with the existence, absence or level of contaminants in drinking water.

**E. DUTIES AND REQUIREMENTS**

1. **Duty to Comply** - The permittee shall comply with all conditions of this permit, except to the extent and for the duration such noncompliance is authorized by an emergency permit pursuant to 40 C.F.R. Section §144.34. Any permit noncompliance constitutes a violation of the SDWA and is grounds for enforcement action, permit termination, revocation, and reissuance or modification.
2. **Penalties for Violations of Permit Conditions** - Any person who operates wells in violation of permit conditions is subject to civil penalties, fines, and other enforcement action under the SDWA and may be subject to such actions under the Resource Conservation and Recovery Act. Any person who willfully violates a permit condition may be subject to criminal prosecution.
3. **Need to Halt or Reduce Activity not a Defense** - It shall not be a defense for a permittee in an enforcement action to state that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.
4. **Duty to Mitigate** - The permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit.
5. **Proper Operation and Maintenance** - The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.
6. **Duty to Provide Information** - The permittee shall furnish to the Director, by the date specified by the Director, any information that the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required by this permit to be retained.
7. **Inspection and Entry** - The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law to:
  - (a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this permit;
  - (b) Have access to and copy, at reasonable times, any records that must be retained under the conditions of this permit;
  - (c) Inspect at reasonable times any facilities, equipment (including monitoring equipment), practices, or operations regulated or required under this permit; and

(d) Sample or monitor the injected fluids, at reasonable times, for the purposes of assuring permit compliance, or as otherwise authorized by the SDWA, at any location.

8. **Records**

(a) The permittee shall retain records of all monitoring information, including all calibration and maintenance records and copies of all records required by this permit, for a period of at least three years from the date of the sample, measurement or report. The permittee shall also maintain records of all data required to complete this permit application and any supplemental information submitted under 40 C.F.R. §§144.31 and 144.51. These periods may be extended by request of the Director at any time by written notice to the permittee.

(b) The permittee shall retain records concerning the nature and composition of all injected fluids until three years after the completion of plugging and abandonment of the last operating injection well covered under this permit. Such plugging and abandonment shall be conducted in accordance with the plugging and abandonment plan, contained in Part III(B) of this permit. The owner or operator shall continue to retain the records after the three year retention period unless he delivers the records to the Regional Administrator or obtains written approval from the Regional Administrator to discard the records.

(c) Records of monitoring information shall include:

- (i) The date, exact place, and the time of sampling or measurements;
- (ii) The name(s) of the individual(s) who performed the sampling or measurements;
- (iii) A precise description of both sampling methodology and the handling of samples;
- (iv) The date(s) analyses were performed;
- (v) The name(s) of the individual(s) who performed the analyses;
- (vi) The analytical techniques or methods used; and
- (vii) The results of such analyses.

9. **Notification Requirements**

(a) Planned Changes - The permittee shall notify and obtain the Director's approval at least 30 days prior to any planned physical alterations or additions to the permitted facility or changes in the injection fluids. Within ten days prior to injection, an analysis of new injection fluids shall be submitted to the Director in accordance with Parts II(B)(2) and II(B)(3) of this permit.

(b) Anticipated Noncompliance - The permittee shall give at least 30 days advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

(c) Transfer of Permits - This permit is not transferable to any person except after notice is sent to the Director at least 30 days prior to transfer and the requirements of 40 C.F.R. §144.38 have been met. The Director may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the SDWA.

(d) Compliance Schedules - Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted to the Director no later than 30 days following each schedule date.

(e) Twenty-four Hour Reporting - The permittee shall report any noncompliance which may endanger health or the environment, including:

(i) Any monitoring or other information which indicates that any contaminant may cause an endangerment to a USDW; or

(ii) Any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between USDWs.

Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

(f) Other noncompliance. The permittee shall report all instances of noncompliance not reported under paragraph (e) of this section, at the time monitoring reports are submitted. The reports shall contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

(g) Other Information - If or when the permittee becomes aware that the permittee failed to submit any relevant facts in the permit application, or submitted incorrect information in a permit application or in any report to the Director, the permittee shall promptly submit such facts or corrected information in accordance with 40 C.F.R. §144.51(l)(8).

(h) Report on Permit Review - Within 30 days of receipt of the final issued permit, the permittee shall report to the Director that the permittee has read and is personally familiar with all terms and conditions of this permit.

10. **Commencing Injection** - The permittee shall not commence injection into any newly drilled or converted well until:

(a) Formation data and injection fluid analysis have been submitted in accordance with Part II(A)(5) and II(B)(2)(c), respectively;

- (b) A report on any logs and tests required under Part II(A)(4) of this permit has been submitted;
- (c) Mechanical integrity of the well has been demonstrated in accordance with Part I(E)(18);
- (d) Any required corrective action has been performed in accordance with Parts I(E)(17) and III(C); and
- (e) Construction is complete and the permittee has submitted to the Director, by certified mail with return receipt requested, a notice of completion of construction using EPA Form 7520-10, a plugging and abandonment plan, a copy of the State permit, and either:

- (i) The Director has inspected or otherwise reviewed the new injection well and finds it is in compliance with the conditions of the permit; or

- (ii) The permittee has not received, within 13 days of the date of the Director's receipt of the report required above, notice from the Director of his or her intent to inspect or otherwise review the new injection well, in which case prior inspection or review is waived and the permittee may commence injection.

- 11. **Signatory Requirements** - All reports or other information requested by the Director shall be signed and certified according to 40 C.F.R. §144.32.
- 12. **Notice of Plugging and Abandonment** - The permittee shall notify the Director at least 45 working days before conversion or abandonment of the injection well.
- 13. **Plugging and Abandonment** - The permittee shall plug and abandon the wells as provided in the plugging and abandonment plans contained in Part III(B) of this permit. Within 60 working days after plugging a well, or at the time of the next quarterly report (whichever is later), the permittee shall submit a report to the Director. The report shall be certified as accurate by the person who performed the plugging operation and shall consist of either:
  - (a) A statement that the well was plugged in accordance with the plan previously submitted to the Director; or
  - (b) If the actual plugging differed from the approved plan, a statement defining the actual plugging and explaining why the Director should approve such deviation. Any deviation from a previously approved plan which may endanger underground sources of drinking water is cause for the Director to require the operator to replug the well.
- 14. **Inactive Wells** - After cessation of operations for a given well for two years the permittee shall plug and abandon the well in accordance with the plan and 40 C.F.R. §144.52 (a)(6) unless the permittee has:
  - (a) Provided notice to the Director; and
  - (b) Described actions or procedures that are deemed satisfactory by the Director, which the permittee will take to ensure that the well will not endanger underground sources of drinking water during the period of temporary abandonment. These actions and procedures shall include compliance with the technical requirements applicable to active

injection wells unless waived, in writing, by the Director.

15. **Financial Responsibility** - The permittee shall maintain financial responsibility and resources to plug and abandon the underground injection well in accordance with 40 C.F.R. §144.52(a)(7) as provided in Attachment R of the administrative record corresponding to this permit action which is hereby incorporated by reference as if it appeared fully set forth herein. The permittee shall not substitute an alternative demonstration of financial responsibility from that which the Director has approved unless the permittee has previously submitted evidence of that alternative demonstration to the Director and the Director has notified the permittee in writing that the alternative demonstration of financial responsibility is acceptable. The financial responsibility mechanism shall be updated periodically, upon request of the Director, except when Financial Statement Coverage is used as the financial mechanism; this coverage must be updated on an annual basis. If additional wells are to be constructed under the conditions of this permit, the permittee shall increase the amount of financial assurance prior to beginning construction to cover the additional cost of plugging and abandonment.
16. **Insolvency**
  - (a) In the event of the bankruptcy of the trustee or issuing institution of the financial mechanism, or a suspension or revocation of the authority of the trustee institution to act as trustee or the institution issuing the financial mechanism to issue such an instrument, the permittee must submit an alternative demonstration of financial responsibility acceptable to the Director within 60 days after such event. Failure to do so will result in the termination of this permit pursuant to 40 C.F.R. §144.40(a)(1).
  - (b) An owner or operator must also notify the Director by certified mail of the commencement of voluntary or involuntary proceedings under Title 11 (Bankruptcy), U.S. Code, naming the owner or operator as debtor, within 10 business days after the commencement of the proceeding. A guarantor of a corporate guarantee must make such a notification if he or she is named as debtor, as required under the terms of the guarantee.
17. **Corrective Action** - The permittee shall shut-in the injection well whenever the permittee or EPA determines that operation thereof may be causing upward fluid migration through the well bore of any improperly plugged or unplugged well in the area of review and shall take such steps as the permittee can to properly plug the offending well(s). Any operation of the well that may cause upward fluid migration from an improperly plugged or unplugged well will be considered a violation of this permit. If the permittee or EPA determines that the permitted well is not in compliance with conditions of this permit, the permittee will immediately shut-in the well until such time as appropriate repairs can be effected and written approval to resume injection is given by the Director. In addition, the permittee shall not commence injection until any and all corrective action has been taken in accordance with any plan contained in Part III(C) of this permit and the requirements in Part I(E)(10) of this permit have been met.
18. **Mechanical Integrity (MI)** - The permittee must establish and shall maintain mechanical integrity of these wells in accordance with 40 C.F.R. §146.8. The mechanical integrity demonstration consists of two parts: Part 1 demonstrates no significant leaks in the casing, tubing, or packer and Part 2 demonstrates no significant fluid movement into an underground source of drinking water (USDW) through vertical channels adjacent to the wellbore. The



permittee shall conduct the mechanical integrity testing as follows:

- (a) Pursuant to 40 C.F.R. §146.8(a)(1), long string casing, injection tubing, and annular seal shall be tested by means of an approved pressure test in accordance with 40 C.F.R. §146.8(b)(2). This test shall be performed upon completion of each well, and at least once every twelfth month beginning with the date of the last approved demonstration and whenever there has been a well workover in which tubing is removed from the well, when the packer is reset, when loss of mechanical integrity becomes suspected during operation, or when a well changes from production to injection.
- (b) Pursuant to 40 C.F.R. §146.8(a)(2), an approved temperature, noise, oxygen activation, or other approved log shall be run upon completion of each well and at least once every 60 months from the date of the last approved demonstration to test for movement of fluid along the borehole. The Director may require such tests whenever a well is worked over. A descriptive report interpreting the results of such logs and tests shall be prepared by a knowledgeable log analyst and submitted to the Director with the test results. Should the nature of the casing preclude the use of a noise, temperature, or oxygen activation log, then pursuant to 40 C.F.R. §146.8(c)(3), cementing records may be used to demonstrate the presence of adequate cement to prevent fluid migration behind the outermost casing and the wellbore. As an alternative to the standard pressure test that would require a packer on tubing set at the bottom of the well in order to contain the test fluid, existing wells may be tested by the water-brine interface test described in the Federal Register (Vol. 57/ No. 7/ January 10/ 1992), and Part III(E) of this permit.
- (c) The permittee shall notify the Director of his or her intent to perform any tests required by this permit at least 30 calendar days prior to such activities. The permittee must follow the procedures described in Part III(E) this permit. If the permittee is unable to follow the EPA approved procedures, then, the permittee must contact EPA to discuss the situation. When the test report is submitted, a full explanation must be provided as to why the approved procedures were not followed. If the approved procedures were not followed, EPA may require the permittee to re-run the test. The permittee shall report the results of a mechanical integrity demonstration within 45 calendar days after completion thereof.
- (d) The permittee shall cause all gauges used in mechanical integrity demonstrations to be calibrated to an accuracy of not less than one-half percent of full scale. A copy of the calibration certificate shall be submitted to the Director or his/her representative at the time of demonstration. The gauge shall be marked in no greater than five p.s.i. increments.
- (e) The permittee shall cease injection in a well if a loss of mechanical integrity occurs or is discovered during a test, or a loss of mechanical integrity as defined by 40 C.F.R. §146.8 becomes evident during operation. Operation of the well shall not resume until the Director gives approval to recommence.

- (f) The permittee shall notify the Director of the loss of mechanical integrity in accordance with the reporting procedures in Parts I(E)(9)(e) and II(B)(3)(b) of this permit.
- (g) The permittee shall report the results of a satisfactory mechanical integrity demonstration as provided in Part II(B)(3)(b) of this permit.
- (h) The permittee shall demonstrate mechanical integrity at any time upon written notice from the Director.

19. **Restriction on Injected Substances** - The permittee shall be restricted to the injection of those fluids listed in Part III A. No fluids other than those from sources noted in the administrative record and approved by the Director shall be injected. Each year, the permittee shall submit a certified statement attesting to compliance with this requirement.

## PART II

### WELL-SPECIFIC CONDITIONS FOR UNDERGROUND INJECTION CONTROL PERMITS

#### A. CONSTRUCTION REQUIREMENTS

1. **Siting** - Notwithstanding any other provision of this permit, the injection well shall inject only into a formation that is separated from any USDW by a confining zone that is free of known open faults or fractures within the area of the review.
2. **Casing and Cementing** - Injection wells shall be cased and cemented to prevent the movement of fluids into or between underground sources of drinking water. The casing and cement used in the construction of the well shall be as described in the permit application, contained within the administrative record corresponding to this permit action, which are hereby incorporated by reference as if they appeared fully set forth herein.
3. **Wellhead Specifications** - A female coupling and valve shall be installed at the wellhead to be used for independent injection pressure readings.
4. **Logs and Tests** - Upon approval of the surface casing and cementation records by the Director, any logs and tests noted in Part III of this permit shall be performed, unless already provided. Prior to commencement of injection, the permittee shall submit to the Director for approval a descriptive report prepared by a knowledgeable log analyst interpreting the results of those logs and tests, along with the notice of completion required in Part I(E)(10) of this permit.
5. **Formation Data** - If not already provided, the permittee shall determine or calculate the following information concerning the injection formation and submit it to the Director for review and approval, prior to operation:
  - (a) Formation fluid pressure;
  - (b) Fracture pressure; and,
  - (c) Physical and chemical characteristics of the formation fluids.
6. **Prohibition of Unauthorized Injection** - Any underground injection, except as authorized by permit or rule issued under the UIC program, is prohibited. The construction, including drilling, of any well required to have a permit is prohibited until a permit has been issued and is effective.

## **B. OPERATING, MONITORING, AND REPORTING REQUIREMENTS**

### **1. Operating Requirements**

- (a) Beginning on the effective date of this permit, the permittee is authorized to operate the injection wells, subject to the limitations and monitoring requirements set forth herein.
- (b) **Injection Pressure Limitation** - Except during stimulation, injection pressure at each wellhead shall not exceed a maximum which shall be calculated so as to assure that the pressure in the injection zone during injection does not initiate new fractures or propagate existing fractures in the injection zone. In no case shall injection pressure initiate fractures in the confining zone or cause the movement of injection or formation fluids into an underground source of drinking water. The injection pressure and injected fluid shall be limited and monitored as specified in Parts I(E)(19) and III(A) of this permit.

### **2. Monitoring Requirements**

- (a) Samples and measurements taken for the purpose of monitoring as required in Part II(B)(3) shall be representative of the monitored activity. Grab samples shall be used to obtain a representative sample of the fluid to be analyzed. Part III(A) of this permit describes the sampling location and required parameters for injection fluid analysis. The permittee shall identify the types of tests and methods used to generate the monitoring data. The monitoring program shall conform to the one described in Part III(A) of this permit.
- (b) **Analytical Methods** - Monitoring of the nature of injected fluids shall comply with applicable analytical methods cited and described in Table I of 40 C.F.R. § 136.3 or by other methods that have been approved by the Director.
- (c) **Injection Fluid Analysis** - The nature of the injection fluids shall be monitored as specified in Part III(A) of this permit. Once the Director has given authorization to commence injection, within 30 days of starting injection an initial analysis of injection fluids will be undertaken. Results of the analysis must be submitted in the next monthly report. Whenever the injection fluid is modified to the extent that the analysis required by 40 C.F.R. §146.34(a)(7)(iii) is incorrect or incomplete a new analysis shall be provided to the Director at the time of the next quarterly report. The Director may, by written notice, require the permittee to sample and analyze the injection fluid at any time.
- (d) **Injection Pressure and Cumulative Volume** – The injection pressure shall be monitored semi-monthly and shall be reported quarterly as specified in Part III(A) of this permit. The injected and produced fluid volumes shall be monitored daily and shall be reported quarterly. All gauges used in monitoring shall be calibrated according to Part I E(18)(d) of this permit. If more than one solution cavity is active, volume data must be reported according to the respective cavity. If over a calendar month period the ratio of the volume of injected fluids to the volume of produced fluids is 1.1 or greater, the permittee must immediately cease injection into the cavity in question and report this condition to EPA within 24 hours. In this circumstance, the permittee shall conduct an investigation to determine the cause of the ratio

discrepancy. The permittee shall submit to EPA a report of the investigation within 15 days of cessation of injection into the well.

3. **Reporting Requirements** - Copies of the monitoring results and all other reports shall be submitted to the Director at the following address:

**U.S. Environmental Protection Agency**

**Region 5**

**77 W. Jackson Boulevard**

**Chicago, Illinois 60604-3590**

**Attn: Water Enforcement & Compliance Assurance Branch (WC-15J)**

(a) **Quarterly Reports** - The permittee shall submit the results of the injection fluid analyses specified in permit conditions in Part (II)(B)(2)(c) and in Attachment A no later than the 10th day of the month following the end of the reporting period. Monitoring results shall be recorded on a form which has been signed and certified according to 40 C.F.R. §144.32. Forms shall be submitted at the end of each quarter and shall be postmarked no later than the 10th day of the month following the reporting period. The first report shall be sent no later than the 10th day of the month following the quarter in which injection commences. This report shall include monthly average, maximum and minimum values for injection pressure, injected and produced volumes and the specific gravity of the injected fluids.

(b) **Reports on Well Tests, Workovers, and Plugging and Abandonment** - The applicant shall provide the Director with the following reports and test results within 45 days of completion of the activity:

(i) Mechanical integrity tests, except tests which the well fails, in which case 24 hour reporting under Part I(9)(e) is applicable;

(ii) Logging or other test data;

(iii) Well workovers (using EPA Form 7520-12); and

(iv) Plugging and abandonment.

(v) Cavern monitoring

**PART III  
SPECIAL CONDITIONS**

These special conditions include, but are not limited to, plans for maintaining correct operating procedures, monitoring conditions, and reporting, as required by 40 C.F.R. Parts 144 and 146. These plans are described in detail in the permittee's application for a permit, and the permittee is required to adhere to these plans as approved by the Director, as follows:

**A. OPERATING, MONITORING, AND REPORTING REQUIREMENTS**

**B. PLUGGING AND ABANDONMENT PLAN (ATTACHED)**

**C. CORRECTIVE ACTION PLAN**

**D. AREA PERMITTED**

**E. TESTING PROCEDURES**

**PART III(A)****OPERATING, MONITORING, AND REPORTING REQUIREMENTS**

<b>CHARACTERISTIC</b>	<b>LIMITATION (if appropriate)</b>	<b>Minimum Monitoring Requirements</b>		<b>Minimum Reporting Requirements</b>
		<b>Frequency</b>	<b>Type</b>	<b>Frequency</b>
<b>*Injection Pressure</b>	355 psig (maximum)	Semi-monthly		quarterly
<b>Specific Gravity</b>	1.05	Semi-monthly	grab	quarterly
<b>Injection Flow Rate</b>	1250 gpm maximum	Semi-monthly		quarterly
<b>Monthly Injected Volume</b>	N/A	daily		quarterly
<b>Monthly Produced Volume</b>	No less than 90% of monthly injected volume	daily		quarterly
<b>**Chemical and Physical Parameters of Injection Fluid</b>	N/A	quarterly	grab	quarterly
<b>Part 1 MIT</b>	N/A	60 months		Per Part II (B)(3)(b) of this permit
<b>Part 2 MIT</b>	N/A	60 months		Per Part II (B)(3)(b) of this permit
<b>Cavern Monitoring</b>	Minimum cavern roof thickness: 30 ft.	Every 3 years	sonar	Per Part II (B)(3)(b) of this permit

**SAMPLING LOCATION:** «Sample\_Location».

\*The limitation on wellhead pressure serves to prevent injection formation fracturing. The maximum wellhead pressure is dependent upon injection formation fracture gradient, depth and specific gravity of the injected fluid. This limitation was calculated using the following formula:

$$[{\langle\text{FractureGrad}\rangle \text{ psi/ft} - 0.433 \text{ psi/ft}(\text{specific gravity} + 0.05)} \times \text{depth}] - 14.7 \text{ psi} = \text{MIP}$$

The fracture gradient of «FractureGrad» psi/ft (default value) was used «Fracture\_Justification». The top of the permitted injection zone («Injection\_Zone») at «Injection\_top» feet was used as the depth, a specific gravity of «SG» was used for the injected fluid.

\*\* Chemical and physical analysis shall include, but not be limited to, the following: Specific Conductivity, Temperature, Total Dissolved Solids, pH, Specific Gravity, Carbonate, Bicarbonate, Chloride, Calcium, Magnesium, Potassium, Sodium

**Composition of Injected Fluids**

The injection fluids will be limited to:

1. Fresh water: to solution mine caverns for future storage of liquified petroleum gas (LPG)
2. Mineral oil or nitrogen gas to control the shape of the top of each of the four cavern wells created by solution mining. Due to the lower density of the mineral oil or nitrogen gas, it will act as a floating “blanket” on top of the water in the cavern during solution mining.

Each year, the permittee shall submit a certified statement attesting to compliance with the requirement of Part I (E)(19) of the permit.

**Cavern Monitoring For Competence of Confining Layer**

The permittee shall maintain a salt cavern roof thickness of a minimum of 30 feet between the bottom of the overlying Salina Group and the salt cavern ceiling at all locations in the caverns. Measurement of the salt cavern roof thickness shall be taken once every three years, with an initial measurement taken before the solution mining commences. The initial measurements will be obtained from drilling logs, with subsequent measurements taken using sonar surveys of the solution cavity. After the initial sonar survey, dimensions from the previous survey must be shown on the diagram. Cross-sectional views shall also include a comparison to previous sonar results. The sonar survey results and interpretation must be submitted to the Director within 60 days of completing the survey.

**Seismicity Response**

Prior to commencing injection, the permittee shall subscribe to the U.S. Geological Survey Earthquake Notification Service to receive notification of seismic events within 100 kilometers (62 miles) of the well. The midpoint between the surface-hole and bottom-hole locations shall be used as the center of the circle. The appropriate response to seismic events depends on the Moment Magnitude ( $M_w$ ) of the seismic event according to the following protocol.

As described below, after a seismic event has been identified, the permittee must make a decision regarding the level of impact a given event could have on injection site operations, whether a response is required, and what the appropriate response will be. This decision and response framework will rely on existing seismic monitoring networks coordinated by the U.S. Geological Survey, followed by a technical evaluation of the injection well by the permittee in order to reduce the likelihood of injectate leaving the injection zone. Identification of events with sufficient Moment Magnitude ( $M_w$ ) that are located within 100 km (62.14 miles) of the injection site can be accomplished through the U.S. Geological Survey’s web site. [In the case of a well with a deviated or horizontal component, the midpoint between the surface-hole location and the bottom-hole location should be used as the center of the circle.] The operational protocol for responding to events will follow a “traffic light” approach (modified after Zoback 2012; National Research Council 2013) that uses three operational states:



**GREEN:** Seismic events not recorded or  $M_w < 3.5$ : Continue normal well injection operations.

**YELLOW:** Seismic events with Moment Magnitude  $3.5 \leq M_w < 5.0$  are observed within a 100 km (62.14 Miles) radius of the site: Injection operations must cease. The permittee will notify the EPA UIC Program Director of any such event within 24 hours, providing information on the status of the injection site. Within 45 days, the permittee will evaluate the mechanical integrity of the internal well systems (Part 1) via a well test approved by the Director. If the well fails the mechanical integrity test or the permittee identifies any problems with the system that might impact underground sources of drinking water (USDW), the injection well must remain shut-in and the permittee must submit a written report as soon as possible but no later than five days from the time the permittee becomes aware of the circumstances. The written submittal shall contain a description of the noncompliance and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance. Upon completion of the steps to ensure mechanical integrity and the subsequent mechanical integrity demonstration, the permittee must submit the results and any other required documentation to EPA's office for final written approval. If the well has mechanical integrity and no problems that might impact USDWs are detected, the permittee must provide proof of those findings to the Director. Injection operations shall not be resumed until the Director gives written approval to recommence injection.

**RED:** Moment Magnitude 5.0 or greater seismic events are observed within a 100 km (62.14 Miles) radius of the site. Injection operations must cease. The permittee will notify the EPA UIC Program Director of any such event within 24 hours, providing information on the status of the injection site. Within 45 days, the permittee will evaluate the integrity of the internal well systems by performing a Part 1 well test approved by the Director, as well as perform an evaluation of the external mechanical integrity of the well pursuant (Part 2) to 40 C.F.R. Part 146.8. If the well fails either mechanical integrity test or the permittee identifies any problems with the system that might impact a USDW, the injection well must remain shut-in and the permittee must submit a written report as soon as possible but no later than five days from the time the permittee becomes aware of the circumstances. The written submittal shall contain a description of the noncompliance and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance. Upon completion of the steps to ensure mechanical integrity and the subsequent mechanical integrity demonstration, the permittee must submit the results and any other required documentation to our office for final approval. Injection operations shall not be resumed until the Director gives written approval to recommence injection.





United States Environmental Protection Agency  
Washington, DC 20460

## PLUGGING AND ABANDONMENT PLAN

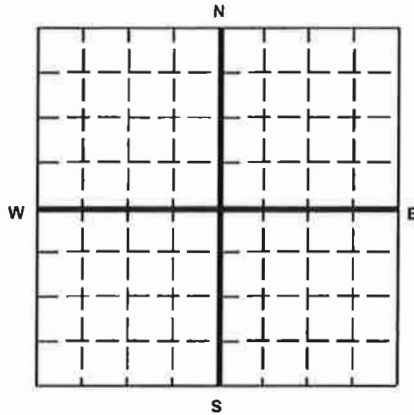
Name and Address of Facility

Buckeye Woodhaven Terminal  
Woodhaven, MI

Name and Address of Owner/Operator

Buckeye Terminals, LLC

Locate Well and Outline Unit on  
Section Plat - 640 Acres



State  
Michigan

County  
Wayne

Permit Number

Surface Location Description

nW 1/4 of NE 1/4 of NW 1/4 of NE 1/4 of Section 22 Township 04S Range 10E

Locate well in two directions from nearest lines of quarter section and drilling unit

Surface

Location \_\_\_\_ ft. from (N/S) \_\_\_\_ Line of quarter section

and \_\_\_\_ ft. from (E/W) \_\_\_\_ Line of quarter section.

TYPE OF AUTHORIZATION

- ☐ Individual Permit  
☒ Area Permit  
☐ Rule

Number of Wells 4

WELL ACTIVITY

- ☐ CLASS I  
☐ CLASS II  
☐ Brine Disposal  
☐ Enhanced Recovery  
☐ Hydrocarbon Storage  
☒ CLASS III

Lease Name

Well Number CW 1

### CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
24			100	
20	94		420	26
13 3/8	61		1015	17 1/2

### METHOD OF EMPLACEMENT OF CEMENT PLUGS

- ☒ The Balance Method  
☐ The Dump Bailer Method  
☐ The Two-Plug Method  
☐ Other

### CEMENTING TO PLUG AND ABANDON DATA:

	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inches)	12.515	12.515					
Depth to Bottom of Tubing or Drill Pipe (ft)	1000	600					
Sacks of Cement To Be Used (each plug)	347.5	521.2					
Slurry Volume To Be Pumped (cu. ft.)	410.0	615.0					
Calculated Top of Plug (ft.)	600	0					
Measured Top of Plug (if tagged ft.)	600	0					
Slurry Wt. (Lb./Gal.)	15.6	15.3					
Type Cement or Other Material (Class III)	H	H					

### LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any)

From	To	From	To
1015	1150		

Estimated Cost to Plug Wells

\$224,050

### Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

Name and Official Title (Please type or print)

Carl A. Ostach, VP Domestic Field Operations

Signature

*Carl A. Ostach*

Date Signed

12/15/17





United States Environmental Protection Agency  
Washington, DC 20460

## PLUGGING AND ABANDONMENT PLAN

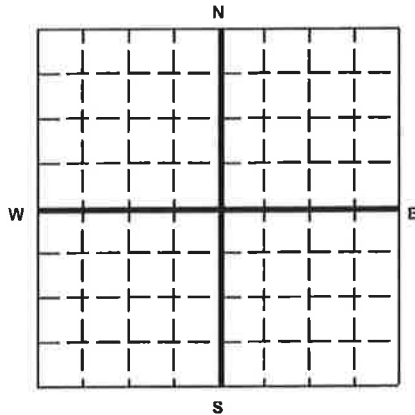
### Name and Address of Facility

Buckeye Woodhaven Terminal  
Woodhaven, MI

### Name and Address of Owner/Operator

Buckeye Terminals, LLC

### Locate Well and Outline Unit on Section Plat - 640 Acres



### State

Michigan

### County

Wayne

### Permit Number

### Surface Location Description

nw 1/4 of NE 1/4 of nw 1/4 of NE 1/4 of Section 22 Township 04S Range 10E

### Locate well in two directions from nearest lines of quarter section and drilling unit

### Surface

Location \_\_\_\_ ft. from (N/S) \_\_\_\_ Line of quarter section

and \_\_\_\_ ft. from (E/W) \_\_\_\_ Line of quarter section.

### TYPE OF AUTHORIZATION

- ☐ Individual Permit  
☒ Area Permit  
☐ Rule

Number of Wells 4

Lease Name

### WELL ACTIVITY

- ☐ CLASS I  
☐ CLASS II  
☐ Brine Disposal  
☐ Enhanced Recovery  
☐ Hydrocarbon Storage  
☒ CLASS III

Well Number CW 2

### CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
24			100	
20	94		420	26
13 3/8	61		1015	17 1/2

### METHOD OF EMPLACEMENT OF CEMENT PLUGS

- ☒ The Balance Method  
☐ The Dump Bailer Method  
☐ The Two-Plug Method  
☐ Other

### CEMENTING TO PLUG AND ABANDON DATA:

	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inches)	12.515	12.515					
Depth to Bottom of Tubing or Drill Pipe (ft)	1000	600					
Sacks of Cement To Be Used (each plug)	347.5	521.2					
Slurry Volume To Be Pumped (cu. ft.)	410.0	615.0					
Calculated Top of Plug (ft.)	600	0					
Measured Top of Plug (if tagged ft.)	600	0					
Slurry Wt. (Lb./Gal.)	15.6	15.3					
Type Cement or Other Material (Class III)	H	H					

### LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any)

From	To	From	To
1015	1150		

### Estimated Cost to Plug Wells

\$224,050

### Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

Name and Official Title (Please type or print)

Carl A. Ostach, VP Domestic Field Operations

Signature

*Carl A. Ostach*

Date Signed

*12/15/17*



OMB No. 2040-0042 Approval Expires 12/31/2018

<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: left;"> </div> <div style="text-align: center;"> United States Environmental Protection Agency  Washington, DC 20460 </div> </div>														
PLUGGING AND ABANDONMENT PLAN														
Name and Address of Facility Buckeye Woodhaven Terminal Woodhaven, MI					Name and Address of Owner/Operator Buckeye Terminals, LLC									
<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <p>Locate Well and Outline Unit on Section Plat - 640 Acres</p> </div> <div style="flex: 1; padding-left: 10px;"> <p>State Michigan</p> <p>County Wayne</p> <p>Permit Number</p> <p>Surface Location Description nw 1/4 of <u>NE</u> 1/4 of <u>nw</u> 1/4 of <u>NE</u> 1/4 of Section <u>22</u> Township <u>04S</u> Range <u>10E</u></p> <p>Locate well in two directions from nearest lines of quarter section and drilling unit</p> <p>Surface Location ____ ft. from (N/S) ____ Line of quarter section and ____ ft. from (E/W) ____ Line of quarter section.</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>TYPE OF AUTHORIZATION</p> <p><input type="checkbox"/> Individual Permit</p> <p><input checked="" type="checkbox"/> Area Permit</p> <p><input type="checkbox"/> Rule</p> <p>Number of Wells <u>4</u></p> </div> <div style="width: 45%;"> <p>WELL ACTIVITY</p> <p><input type="checkbox"/> CLASS I</p> <p><input type="checkbox"/> CLASS II</p> <p><input type="checkbox"/> Brine Disposal</p> <p><input type="checkbox"/> Enhanced Recovery</p> <p><input type="checkbox"/> Hydrocarbon Storage</p> <p><input checked="" type="checkbox"/> CLASS III</p> </div> </div> <p>Lease Name</p> </div> </div>					<p>Well Number <u>CW 3</u></p>									
					CASING AND TUBING RECORD AFTER PLUGGING					METHOD OF EMPLACEMENT OF CEMENT PLUGS				
					SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE	<input checked="" type="checkbox"/> The Balance Method <input type="checkbox"/> The Dump Bailer Method <input type="checkbox"/> The Two-Plug Method <input type="checkbox"/> Other				
					24			100						
20	94		420	26										
13 3/8	61		1015	17 1/2										
CEMENTING TO PLUG AND ABANDON DATA:					PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7			
Size of Hole or Pipe in which Plug Will Be Placed (inches)					12.515	12.515								
Depth to Bottom of Tubing or Drill Pipe (ft)					1000	600								
Sacks of Cement To Be Used (each plug)					347.5	521.2								
Slurry Volume To Be Pumped (cu. ft.)					410.0	615.0								
Calculated Top of Plug (ft.)					600	0								
Measured Top of Plug (If tagged ft.)					600	0								
Slurry Wt. (Lb./Gal.)					15.6	15.3								
Type Cement or Other Material (Class III)					H	H								
LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (If any)														
From		To		From		To								
1015		1150												
Estimated Cost to Plug Wells														
\$224,050														
<b>Certification</b>  I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)														
Name and Official Title (Please type or print) Carl A. Ostach, VP Domestic Field Operations					Signature 				Date Signed 12/15/17					







United States Environmental Protection Agency  
Washington, DC 20460

## PLUGGING AND ABANDONMENT PLAN

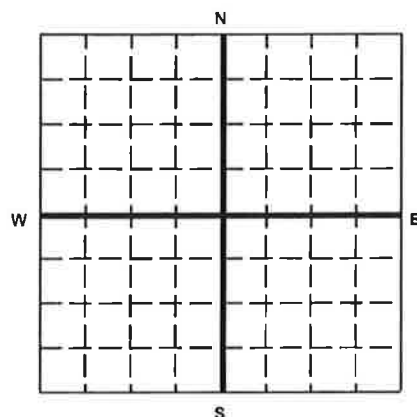
### Name and Address of Facility

Buckeye Woodhaven Terminal  
Woodhaven, MI

### Name and Address of Owner/Operator

Buckeye Terminals, LLC

### Locate Well and Outline Unit on Section Plat - 640 Acres



State  
Michigan

County  
Wayne

Permit Number

### Surface Location Description

nw 1/4 of NE 1/4 of nw 1/4 of NE 1/4 of Section 22 Township 04S Range 10E

Locate well in two directions from nearest lines of quarter section and drilling unit

### Surface

Location \_\_\_\_ ft. from (N/S) \_\_\_\_ Line of quarter section

and \_\_\_\_ ft. from (E/W) \_\_\_\_ Line of quarter section.

### TYPE OF AUTHORIZATION

- ☐ Individual Permit  
☒ Area Permit  
☐ Rule

Number of Wells 4

Lease Name

### WELL ACTIVITY

- ☐ CLASS I  
☐ CLASS II  
☐ Brine Disposal  
☐ Enhanced Recovery  
☐ Hydrocarbon Storage  
☒ CLASS III

Well Number CW 4

### CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
24			100	
20	94		420	26
13 3/8	61		1015	17 1/2

### METHOD OF EMPLACEMENT OF CEMENT PLUGS

- ☒ The Balance Method  
☐ The Dump Bailer Method  
☐ The Two-Plug Method  
☐ Other

### CEMENTING TO PLUG AND ABANDON DATA:

	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (Inches)	12.515	12.515					
Depth to Bottom of Tubing or Drill Pipe (ft)	1000	600					
Sacks of Cement To Be Used (each plug)	347.5	521.2					
Slurry Volume To Be Pumped (cu. ft.)	410.0	615.0					
Calculated Top of Plug (ft.)	600	0					
Measured Top of Plug (If tagged ft.)	600	0					
Slurry Wt. (Lb./Gal.)	15.6	15.3					
Type Cement or Other Material (Class III)	H	H					

### LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any)

From	To	From	To
1015	1150		

### Estimated Cost to Plug Wells

\$224,050

### Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

Name and Official Title (Please type or print)

Carl A. Ostach, VP Domestic Field Operations

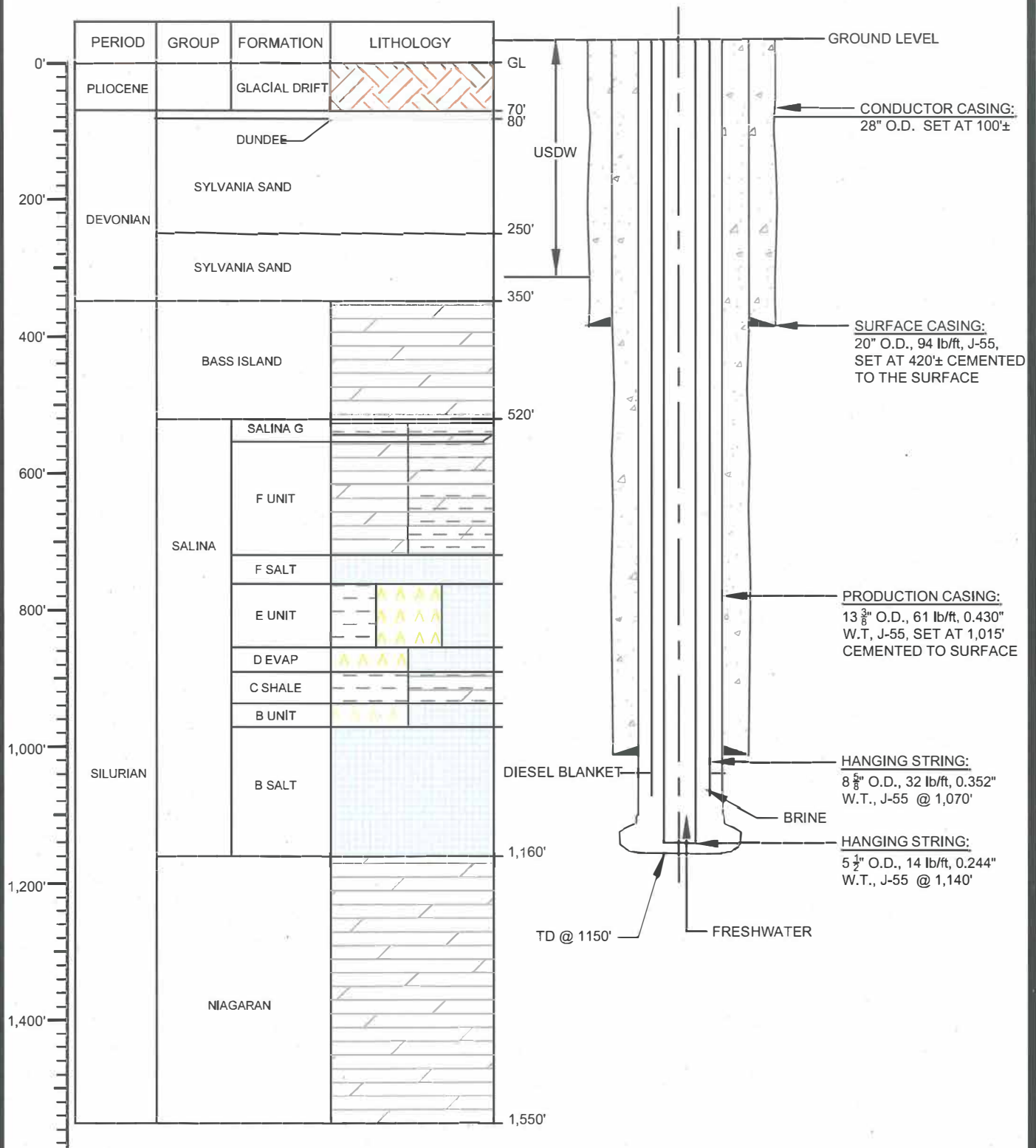
Signature

*Carl A. Ostach*

Date Signed

*12/15/17*





Note: Top of formation depths are estimated based on surrounding geology information.



WSP USA Inc.  
16200 Park Row Suite 200  
Houston, Texas 77084  
TEL: (281) 589-5900

BUCKEYE TERMINALS, LLC  
WOODHAVEN TERMINAL  
WAYNE COUNTY, MICHIGAN

### PROPOSED CASING PROGRAM - LEACHING OPERATIONS

Job No. 192065A

Design: WDD

Drawn: WDD

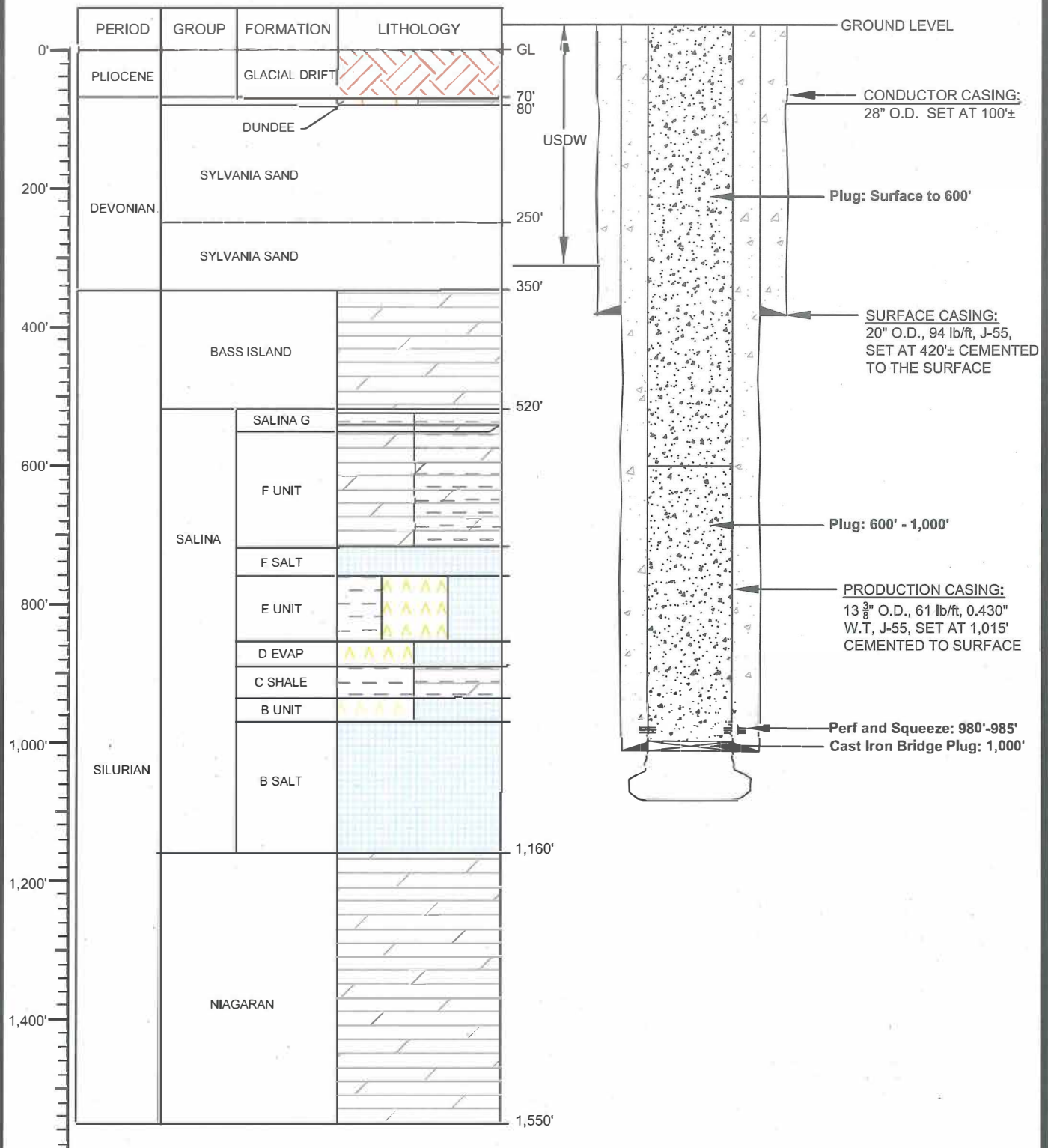
Checked: GM

Date: 11/14/17

Scale: 1"=100'

Drawing No. M-1





Note: Top of formation depths are estimated based on surrounding geology information.



WSP USA Inc.  
16200 Park Row Suite 200  
Houston, Texas 77084  
TEL: (281) 589-5900

BUCKEYE TERMINALS, LLC  
WOODHAVEN TERMINAL  
WAYNE COUNTY, MICHIGAN

**PROPOSED PLUG & ABANDON CAVERN WELL CONSTRUCTION AND STRATIGRAPHY**

Job No. 192065A

Design: WDD

Drawn: WDD

Checked: GM

Date: 10/03/2017

Scale: 1"=100'

Drawing No. Q-1



**PART III(C)**  
**CORRECTIVE ACTION PLAN**

No corrective action is required at this time.





**PART III(D)**  
**AREA PERMITTED**

The four cavern wells will be located at NW  $\frac{1}{4}$ , NW  $\frac{1}{4}$ , NE  $\frac{1}{4}$ , Section 22 Township 4 South, Range 10 East, just south of West Road, about 0.5 mile east of Interstate 75, in the town of Woodhaven, Michigan, within the property boundaries of the Woodhaven Terminal facility of Buckeye Terminals, LLC.



**PART III(E)**  
**Approved Test Procedures**

**Standard Annulus Pressure Test**

1. Ensure the packer is set within 100 feet of the top of the injection zone. Packers not set within 100 feet of the top of the injection zone will be evaluated by EPA on a case-by-case basis. Note any approved deviations from previously reported well construction.
2. Document the test using a mechanical or digital device or a service company job record which records the value of the parameters of interest as measured during the test.
  - a. Submit along with the test results a gauge calibration certificate for the mechanical or digital device used to record test parameters. All calibration (for new or recalibrated gauges) must have been performed within a year prior to the test.
  - b. Place a gauge on the wellhead to measure pressure. If a recording device is used, the recording device serves to verify the data witnessed on the wellhead gauge.
  - c. Use an appropriately scaled mechanical gauge which has a measurement range that is 1.2 – 2 times the maximum pressure measured or a 1 psi resolution digital gauge with sufficient full scale.
  - d. Measure and document pressure using a gauge and/or a digital record and/or a chart record that can be read with sufficient accuracy to identify pressure change which would result in a failure of the test and to record accurate values during the test interval. For example, if the test pressure is 300 psig, the gauge and/or chart record should be marked in increments of 5 psi or less.
3. Verify that the tubing/casing annulus is full of liquid. No unapproved fluids that may affect test outcomes are allowed. Measure and report the volume of liquid added to the annulus during pressurization (if any). If an annulus tank is pressurized with nitrogen to pressurize the well, record the liquid displaced from the tank into the well annulus.
4. Stabilize the temperature of the well and the annulus liquid, either by ceasing injection or injecting at a constant fixed rate. Ensure that the wellhead injection tubing pressure is at least 100 psi different from the annulus test pressure.
5. Pressurize the annulus to the greater of 300 psig or the maximum permitted injection pressure plus 100 psi. A positive pressure differential of greater than 100 psi should be maintained between the annulus and the injection tubing. If EPA does not approve any deviations from this criteria prior to testing, the test results might not be considered a sufficient demonstration of mechanical integrity and a new test would then be needed. A net gain or loss of more than 3% during the test indicates the well does not have mechanical integrity. Following pressurization, isolate the annular system from its pressure source and, if present, the sealpot or surge tank being sure to prevent any leaking across the shut-off valves.
6. Test for at least 60 minutes. Note the time, the annulus pressure, and the injection/tubing pressure at the start of the test and measure and note these same parameters at least every 10 minutes thereafter up to the end of the required test duration.
7. Send a report of the testing including any other data or documents available at the conclusion of the test which support the test results, such as gauge calibration certification, third-party service ticket, and/or original chart/digital recordings, to EPA per the reporting requirements of the permit.
8. If the tested well was reworked in association with the test, submit a rework record.
9. Include the certification statement and signature on the transmittal letter or on the individual MIT results form and, if submitted, the rework record to comply with the requirements of 40 CFR § 144.32(b).

**Temperature Log**

1. To conduct a static temperature log, the well must be shut in for at least 36 hours, or longer if temperature stabilization based on previous logs requires more time.
2. If the well cannot be shut in for 36 hours, shut in for as long as possible and run two logs at least six hours apart.
3. Calibrate the temperature tool in a bucket of ambient temperature water and a bucket of ice water immediately prior to conducting the test.
4. Log from the top of the well to the bottom, recording both temperature and natural gamma ray activity.
5. Record log data at least once per foot.
6. Logging speed shall not exceed 30 feet per minute. Reduce speed to 20 feet per minute in air-filled well bores.
7. The test shall include a written report by a knowledgeable log analyst. Such report must explain any anomalies shown in the results.
8. The test report shall include an up-to-date well schematic, digital logging data on CD/flash drive/email in a spreadsheet format, and a plot of the logging activity.
9. The test report shall include a tabulation of values for the following background parameters: EPA permit number, long string casing length (ft), tubing and/or tail pipe lowermost depth (ft), top of open hole or uppermost perforation (ft), well total depth (ft), plugged back total depth or top of fill depth (ft), Kelly bushing elevation (ft), depth to top of confining zone (ft), and depth to top of permitted injection zone (ft). The test report shall also include a tabulation of values for the following test specific parameters: test date, depth reference (Kelly bushing or ground level), date of last injection, temperature of last injected fluid (F), elapsed time since last injection (hr), volume injected into the well in the past year (gal), names and depths of any other injection formations used at the site, temperatures logged by the tool and thermometer during calibration (F), depth to liquid level in the tubing (ft), depth to top of receptive strata (ft), and depth to bottom of receptive strata (ft).
10. The test must conclusively demonstrate its objectives and satisfy the Director to be considered a completed test.

**Water-Brine Interface Test**

1. Flush the well to be tested with sufficient fresh water (minimum of one casing volume) to dissolve any salt precipitated on the interior of the casing.
2. Withdraw brine from the test well until the specific gravity of the brine remains constant. Measure and record the specific gravity value.
3. Measure and record the test wellhead pressure.
4. Withdraw brine from a reference well until the specific gravity of brine is constant. Shut in the reference well and take a pressure reading. Record the wellhead pressure. Tubing may serve as the reference well and the casing-tubing annulus functions as the test well.
5. Inject fresh water (or oil) into the test well in sufficient quantities to fill all but the bottom 50 ft of the production casing. To achieve this, inject fresh water (or oil) until the wellhead pressure increases by an amount calculated using the following formula:

Pressure increase =  $(D-50) \times (SG1-SG2) \times k$       where:

D = depth of the well (in ft)

SG1 = the specific gravity<sub>(water)</sub> of the cavern brine

SG2 = the specific gravity<sub>(water)</sub> of the injected liquid (water or oil), and

k = 0.4331 psi/ft, a conversion constant (pressure gradient for fresh water)

Determine whether there has been any change in the measured pressure in the reference well during the injection phase. Add the net pressure change to the calculated pressure increase for the test well to obtain the final pressure necessary for proper placement of the interface. (Where the

a low specific gravity may be substituted for fresh water in order to provide a sufficient density contrast. The use of oil under these specific circumstances represents a modification to the original test procedure).

6. In order to avoid mixing and maintain a sharp interface, inject the fresh water (or oil) at a rate that will not cause the interface to move downward at a rate greater than 20 feet per minute.
7. Wait a minimum of 38 hours for the test and reference wells to come to temperature equilibrium.
8. At the conclusion of the waiting period, compare the pressures of both the test and reference wells against the initial pressures at the start of the waiting period to assure that there has been no significant movement of the interface. If pressure differences can be explained by the well's coming to temperature equilibrium, then the test may proceed. If pressure differences cannot be explained by changes caused by the wells coming to temperature equilibrium, the operator must withdraw a minimum of one casing volume of liquid from both the test and reference wells and restart the test at step 1.
9. The operator must simultaneously measure the wellhead pressures for both the test and reference wells. The pressure readings must be taken using a deadweight pressure gauge or pressure transducer system having a sensitivity of 0.1 psi or greater. If a deadweight pressure gauge is used, then a minimum of ten readings should be taken, at one-minute intervals, over a ten-minute period. If an electronic pressure transducer system is used then one reading during the ten minute measurement period is sufficient. (Because electronic pressure transducers continuously calculate an averaged signal response, only one reading is required.)
10. Calculate the average pressure at the test well and the reference well and the difference between them. Record all data in a standard format.
11. Repeat Steps 9 & 10, at two-hour intervals, for a total test period of eight hours (five averaged readings).
12. For each two-hour interval, and the eight-hour test period, calculate the net pressure change rate at the test well as follows:
 
$$P_{(start)} - P_{(end)}$$

$$NPCR = P_{(start)} - P_{(end)} / \text{Hrs}$$
 where: NPCR = Net Pressure Change Rate (psi/hr)  $P_{(start)}$  = average pressure of test well at the beginning of the test minus average pressure of reference well at the start of the test (psi)  
 $P_{(end)}$  = average pressure of the test well at the conclusion of the test minus the average pressure of the reference well at the conclusion of the test (psi)  
 Hrs = hours in the test period
13. If the calculation for the eight-hour test period indicates a net pressure change rate of less than 0.05 psi/hr, the well has demonstrated mechanical integrity. Pressure change rates that are greater than 0.05 psi/hr indicate a lack of mechanical integrity.
14. The test report shall include a tabulation of values for the following background parameters: EPA permit number, long string casing length (ft), long string casing outer diameter (in), long string casing weight (lbs/ft), tubing and/or tail pipe lowermost depth (ft), tubing outer diameter (in), top of open hole or cavern (ft), well total depth (ft), plugged back total depth or top of fill depth (ft), Kelly bushing elevation (ft), and depth to top of permitted injection zone (ft). The test report shall also include a tabulation of values for the following test specific parameters: test date, depth reference (Kelly bushing or ground level), specific gravity<sub>(water)</sub> of cavern brine, type of test liquid, specific gravity<sub>(water)</sub> of test liquid, name of the reference well used, specific gravity<sub>(water)</sub> of liquid in the reference well, and the pressure measurements at the test and reference wells with corresponding dates and times.
15. The test must conclusively demonstrate its objectives and satisfy the Director to be considered a completed test.